

Claims

What is claimed is:

1. A system for evaluating a charge state of a battery, comprising:
a light source configured for emitting light through an electrolyte within the battery; and
an optical element configured for determining the charge state based on the light passing through the electrolyte.
2. The system of claim 1, wherein the electrolyte is at least one of a liquid and a gel.
3. The system of claim 2, wherein the liquid comprises sulfuric acid.
4. The system of claim 1, wherein the electrolyte is encapsulated within cells of the battery and wherein the battery is a lead-acid battery.
5. The system of claim 1, further comprising an optical barrier configured for preventing the light from directly traveling from the light source to the optical element.
6. The system of claim 1, wherein the light source comprises a light emitting diode.
7. The system of claim 1, wherein the light source comprises a shutter configured for discretely emitting the light from the light source.
8. The system of claim 1, wherein the optical element comprises a light sensor configured for receiving the light passing through the electrolyte.
9. The system of claim 8, wherein the light sensor is a charged coupled device configured for receiving the light at a particular location of the charged coupled device.

10. The system of claim 9, further comprising a processor configured for determining the charge state based on the particular location of the light impinging the charge coupled device.

11. The system of claim 1, further comprising a processor configured for determining the charge state based on a specific gravity of the electrolyte and an index of refraction of the electrolyte.

12. The system of claim 11, wherein the processor is further configured for generating a least mean squares approximation of the index of refraction with respect to the specific gravity.

13. The system of claim 1, further comprising a mirrored surface configured for reflecting the light to the optical element based on a pre-determined evaluation of the index of refraction of the electrolyte, wherein reflected light is used to determine the charge state.

14. A system for evaluating a charge state of a battery, comprising:
a light source; and
a charge detector in communication with the light source and configured for determining the charge state in real-time.

15. The system of claim 14, wherein the battery comprises an electrolyte that is at least one of a liquid and a gel.

16. The system of claim 14, wherein the light source comprises a light emitting diode.

17. The system of claim 14, wherein the light source comprises a shutter configured for discretely emitting the light from the light source.

18. The system of claim 14, wherein the charge detector comprises a light sensor configured for receiving the light passing through an electrolyte within the battery.

19. The system of claim 18, wherein the light sensor is a charged coupled device configured for receiving the light at a particular location of the charged coupled device.
20. The system of claim 19, further comprising a processor configured for determining the charge state based on a specific gravity of an electrolyte within the battery and an index of refraction of the electrolyte as determined by the particular location of the light impinging the charge coupled device.
21. A method of evaluating a charge state of a battery, comprising steps of:
directing light through an electrolyte within the battery; and
determining a value of the charge state based on the light passing through the electrolyte.
22. The method of claim 21, wherein the step of directing comprise a step of emitting the light.
23. The method of claim 21, wherein the step of directing comprise a step of shuttering the light.
24. The method of claim 21, wherein the step of determining comprising a step of detecting the light at a particular location to determine an index of refraction of the electrolyte.
25. The method of claim 23, wherein the step of determining further comprises a step of determining the value of the charge state based on the index of refraction of the electrolyte and an associated a specific gravity of the electrolyte.
26. A system for evaluating a charge state of a battery, comprising:
a light source; and
a charge detector in communication with the light source and configured for non-intrusively determining the charge state.

27. A system for evaluating a charge state of a battery, comprising:
a light source configured for emitting light; and
an optical element, responsive to the light, configured for determining the
charge state based on optical properties of an electrolyte within the battery.